Our ref: 11056P5 WO/JCM.ms Your ref: Date: 9 August 2004

BY FACSIMILE & POST

European Patent Office
International Preliminary Examination Authority
D-80298
Munich
GERMANY

Dear Sirs

International Patent Application No.PCT/GB03/02938
Reckitt Benckiser (Australia) Pty Limited

We write to you in response to the Written Opinion dated 8 April 2004. The Examiner is thanked for granting the applicant a one month extension period within which to respond to the Written Opinion.

In response to the Written Opinion we enclose new pages 3, 6, 7 and 10 to 16. For the assistance of the Examiner, we also enclose these pages showing the proposed changes in manuscript.

Novelty

The Examiner has indicated that claims 1-7 & 51 are "product by process" claims. As such the Examiner concludes that novelty cannot be conferred on these claims unless the product *per se* is novel.

Accordingly, it is proposed to introduce into claim 1 a feature that defines the structural element *per se* rather then relying upon the means by which the structural element is formed by vacuum moulding. Amended claim 1 is in the following terms with the additional feature underlined:

A combustible pesticidal product comprising a structural element having a thickness defined by sides which slope at an angle of from 5 to 10 degrees and formed of a vacuum moulded pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof, the product including one or more pesticides, which product on combustion emanates the pesticide into the atmosphere.

Support for this feature is to be found in the specification page 5 lines 21-23 and page 7 lines 24-28. For the convenience of the Examiner, on page 5 lines 21-23 it is stated

"To aid transfer of the pulp product from the mould, the sides of the mould may be slightly tapered. An angle of 0-30 degrees, preferably 5-10 degrees is commonly used and is termed the 'draft angle'." To further assist the Examiner in his understanding, enclosed is a sketch that illustrates the relevant features. In particular the Examiner will note that inherently, in a moulding process, the item being moulded takes the shape of the mould. Thus in this case, the 5-10 degree angle of taper will inevitably be a feature of the moulded product. Moreover, on page 7 lines 24-28 the thickness of the structural element is explicitly discussed.

Accordingly, the person skilled in the art following the clear teaching and disclosure of the specification would inevitably produce a pesticidal product, which as a result of using the relevant vacuum moulding process, would possess the feature of having a thickness defined by sides which slope at an angle of from 5 to 10 degrees.

Having regard to the inclusion of this feature into claim 1, it is evident that this is novelty conferring over D1-D4 as each of these documents is wholly silent on this point. It therefore follows that each of the claims dependant on claim 1 are novel, i.e. claims 1-46.

Clarity

Claims 7,8,9,12,19 and 44 have been amended to take account of the Examiner's objections. Claims 18,49-51 have been deleted.

Inventive Step

The Examiner regards D1 and D3 as the closest prior art. However, taking into consideration the teaching and disclosure of these documents, it is quite clear that neither document even suggests the use of vacuum moulding in the formation of mosquito coils.

The advantage of vacuum moulding is set out in the specification on page 3 lines 14-17:

> "This has been achieved by recognising that rather than forming the coils as planar helices which need to be handled with care, the coils are moulded to a form which significantly reduces the chance of breakage and does not involve cutting thick cardboard".

On the same page, it is clearly stated that at line 20 "...a structural element formed of a vacuum moulded pulp..."

As set out above in relation to the issue of novelty, the features of the structural element due to formation by vacuum moulded, are not found or suggested in either of

D1 or D3. In particular, neither document mentions a mosquito coil having a thickness defined by sides which slope at an angle of from 5 to 10 degrees. Nor is it clear how the person skilled in the art could derive such a feature from a fair consideration of the contents of these documents.

Further Comments

The relevant passage relating to drawings has been deleted as has the passage on page 11 lines 16-20.

We believe it would now be appropriate to issue a clear International Preliminary Examination Report.

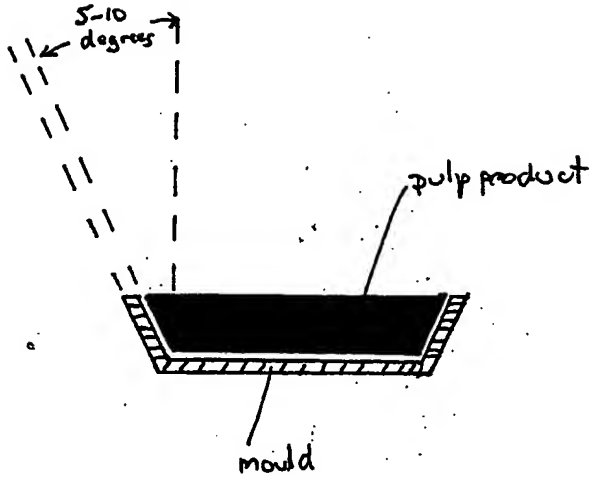
For 1037 is enclosed to enable you to acknowledge receipt hereof.

Yours faithfully
RECKITT BENCKISER plc

John C McKnight

Encs

H:HQ\Patents\Shared\JCM\Crrspndnc\11056P5 WOresponse


5-10
degrees
pulp product
mould

avoid breakage. Again it must be emphasised that any breakage of a coil effectively results in a coil being shortened both in length and most significantly, burn time.

Another known method of making mosquito coils is by treating thick pieces of cardboard with an insecticide. The cardboard may be made of layers of thinner sheets which are stacked on top of one another until the desired thickness is achieved. The multi-layered cardboard is then cut to the required shape of the coil. While this method reduces the breakage of the coil, the cutting of the thick cardboard results in the damage and breakage of the cutting knives. The costs associated with the regular replacement of the knives is significant.

Whilst recognising the short comings of traditional mosquito coils, the present inventors have sought to provide an improved coil which is capable of providing a prolonged effective period of insecticidal coverage and is produced in a manner resulting in a cost effective product relative to the traditional coil.

This has been achieved by recognising that rather than forming the coils as planar helices which need to be handled with some care, the coils are moulded to a form which significantly reduces the chance of breakage and does not involve cutting thick cardboard. <having a thickness defined by side which slope at an angle of from 5 to 10 degrees ish>

Disclosure of Invention

Accordingly, in a first aspect the present invention consists in a combustible pesticidal product comprising a structural element formed of a vacuum moulded pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof, the product including one or more pesticides,

which product on combustion emanates the pesticide into the atmosphere.

In a second aspect, the present invention consists in a method of making a combustible pesticidal product comprising the steps of:

forming a pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof,

the addition of one or more pesticides, and

moulding the product by vacuum moulding

to form a combustible pesticidal product.

charcoal powder, sawdust, cotton, cloths, rags, and husks of materials such as rice, wheat and coconuts. Preferably, old newspaper is used.

Whilst this invention is applicable to a variety of pesticidal substances, the preferred form relates to the use of insecticides, particularly insecticides that are effective against mosquitoes.

The insecticides used in this invention comprise all residual insecticides, including non-microencapsulated insecticides, microencapsulated insecticides as well as mixtures of non-microencapsulated and microencapsulated insecticides.

It is preferred that the one or more insecticides comprise substances which are toxic to mosquitoes. Without limitation, these include esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin, pyrethrins, citronella, pyrethroids, neem oil and mixtures thereof. When esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin, pyrethrins, and mixtures thereof are used, typically they will be in an amount of from 0.01 to 0.6 % w/w, preferably to 0.02 to 0.3 % w/w, most preferably 0.04 to 0.1 % w/w. When pyrethroids, neem oil, citronella and mixtures thereof are used, typically they will be in an amount of from 0.01 to 10 % w/w, preferably to 0.01 to 6 % w/w, most preferably 0.04 to 6 % w/w.

Emanation of the pesticide into the atmosphere occurs as a result of the pesticide being volatilised as the coil burns. At the front or tip of combustion of a coil, the temperature may be 200-500°C. However, behind the tip, the temperature will be somewhat lower owing to the insulation properties of the pulp. This means that compounds such as esbiothrin which boil at 160-170°C will be volatised and released into the atmosphere behind the burning tip.

The pulp may include an accelerant, being an alkali earth metal nitrate or nitrite in an amount of from 0.04 to 1.83 % w/w. Preferably, the alkali earth metal nitrate or nitrate will be included in an amount of from 0.20 to 1.20 % w/w, most preferably about 1.11 % w/w. The nitrates or nitrites that may be used include sodium, potassium, calcium, magnesium and mixtures thereof. It is preferred to utilise potassium as the nitrate or the nitrite, preferably as the nitrate.

As an alternative to the alkali earth metal nitrate or nitrite, the pulp may include an alkali earth carbonate or bicarbonate in an amount of from 0.02 to 1.83 % w/w.

or alkali

Preferably the alkali earth metal carbonate or bicarbonate will be included in an amount of from 0.10 to 1.00 % w/w, most preferably about 0.82 % w/w. The carbonates or bicarbonates that may be used include sodium, potassium, calcium, magnesium and mixtures thereof.

It is preferred to use potassium carbonate.

Sodium silicate may be included in the pulp in an amount of from 0.01 to 1.37 % w/w. Preferably, the sodium silicate may be included in an amount of from 0.10 to 0.70 % w/w, most preferably about 0.56 % w/w.

A phosphate in an amount of from 0.01 to 0.40 % w/w and selected from the group consisting of diammonium phosphate, monoammonium phosphate, triammonium phosphate and mixtures thereof may be included in the pulp. Preferably the phosphate may be included in an amount of from 0.02 to 0.40 % w/w, most preferably about 0.14 % w/w. Furthermore, of these phosphates, diammonium phosphate is preferred.

A boron compound in an amount of from 0.01 to 0.92 % w/w and selected from the group consisting of boric acid, sodium tetraborate hydrous, sodium borate, potassium borate, calcium borate, zinc perborate, boronatrocalcite and mixtures thereof may be included in the pulp. Preferably the boron compound may be included in an amount of from 0.10 to 0.70 % w/w, most preferably about 0.66 % w/w. Furthermore, of these boron compounds, sodium borate is preferred.

It is within the scope of this invention to include a perfume and/or a dye. Both the perfume and the dye, if included, will be selected on the basis of satisfying specific organoleptic requirements. It will of course be appreciated that the perfume must be suitably stable under the conditions of combustion of the coil.

The thickness and width of the pulp are of great importance in determining the burn rate of the coil. It is desired to have a coil which has a low burn rate as less mass is required in the coil. In a preferred embodiment, the structural element is made from moulded pulp, with dimensions of 3-10mm wide by 1-6mm thick, preferably 6mm wide and 4mm thick. The desired length is from 500 to 1500mm, preferably 1100mm. The cross-sectional combustion area is shaped in a rectangle, triangle, square, half-circle, u section or combinations thereof. Where the coil is a single helical coil, the weight of the single coil is 8 to 20 grams, preferably 12 grams.

Figure 2 is a graph showing the effect of width on burn rate of three different products with a density of 450 ± 50kg/m^3.

~~Figure 3a is a plan view of the moulding apparatus of Example 1~~

~~Figure 3b is a sectional view A-A of Figure 3a.~~

~~Figure 4 is a view of the vacuum apparatus used in conjunction with the moulding apparatus.~~

In order to better understand the nature of the invention, a number of examples will now be described.

Example 1

As shown in Figure 3b the moulding apparatus 10 comprises four metal components 11,12,13 and 14. The components are a support plate 11, overlaid by a stainless steel mesh screen 12, a suction mould 13, and a press tool 14. Mesh screen 12 is fixed to the mould 13 using fasteners at location 15 in a manner such that the screen is sandwiched between support plate 11 and mould 13.

In use, the mould 13 is placed into a vacuum vessel 16 containing water 17 which is connected to a vacuum pump 18 by a vacuum hose 19 as shown in Figure 4. A 0.5% pulp solution was made by dispersing old newspaper in water with no additives. The pulp solution was poured into the mould 13 and the pressure was reduced to between 3 and 50kPa (abs) using a vacuum pump. Once the pulp solution had all been added and sufficiently dewatered the press tool 14 was pressed down into the mould 13 as is best seen in Figure 4. This further dewatered the pulp and was found to produce samples of relatively consistent quality that had a density of about 300kg/m^3. The moulding apparatus 10 was then dismantled and the pulp strips removed and dried in an oven at 65°C. To achieve densities greater than 300kg/m^3, the pulp strips were placed back in the mould 13 after drying and compressed between the press tool 14 and the support plate 11 using a hydraulic press. Old newspaper was found to sustain combustion at ~~densities below 600kg/m^3 without the need for accelerants.~~

Example 2

Trials were conducted to compare the effect on burn rate when the thickness, width and density of the strips were altered. Strips were produced of lengths between 4-9mm,

with a thickness of 2,3,4and 5mm at densities of 300,450 and 600kg/m^3. These strips were then burnt to determine their mass burn rate in g/h.

Figure 1 shows the effect of varying thickness and widths on burn rate.

The observed trends were that increasing width increases burn rate, and increasing thickness increases burn rate.

Figure 2 shows the effect on the burn rate of the product with a density of 450 ± 50kg/m^3 when an accelerant (KNO_3) is added to newspaper pulp and also when using white office paper instead of old newspaper as the main ingredient.

Example 2.

Trials were conducted to compare the effect on burn rate when white office paper was used as the main ingredient and also when the accelerant potassium nitrate (KNO_3) was used with old newspaper. KNO_3 was added at a concentration of 0.125% in the pulp solution. Figure 2 shows that using white office paper as a raw material increases the burn rate dramatically. Likewise the addition of KNO_3 to old newspaper slightly increases the burn rate compared to old newspaper with no additives.

~~It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.~~

CLAIMS: < having a thickness defined by sides which slope at an angle of from 5 to 10 degrees and

1. A combustible pesticidal product comprising a structural element formed of a vacuum moulded pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof, the product including one or more pesticides, which product on combustion emanates the pesticide into the atmosphere.

2. A combustible pesticidal product as in claim 1 wherein the product is formed of a thermoformed pulp.

3. A combustible pesticidal product as in claim 2 wherein the product is thermoformed at a temperature of between 80 to 400°C, and at a pressure of between 50 to 1500kPa.

4. A combustible pesticidal product of claim 3 wherein the product is thermoformed at a temperature of 250°C.

5. A combustible pesticidal product of claim 3 wherein the product is thermoformed at a pressure of between 200 to 600kPa.

6. A combustible pesticidal product of claim 4 wherein the product is thermoformed at a pressure of 400kPa.

7. A combustible pesticidal product as in any one of the preceding claims wherein the product comprises either incorporating into the wet pulp during its preparation and/or applying to a pulp as a coating thereof at least one of the following:

<alkali or> an alkali earth metal nitrate or nitrite in an amount of from 0.04 to 1.83% w/w, an alkali <or alkali> earth carbonate or bicarbonate in an amount of from 0.02 (0.1) to 1.83 (1.00)% w/w;

sodium silicate in an amount of from 0.01 to 1.37% w/w;

a phosphate in an amount of from 0.01 to 0.40% w/w and selected from the group consisting of diammonium phosphate, monoammonium phosphate, triammonium phosphate and mixtures thereof;

a boron compound in an amount of from 0.01 to 0.92% w/w and selected from the group consisting of boric acid, sodium tetraborate hydrous, sodium borate, potassium borate, calcium borate, zinc perborate, boronatrocalcite and mixtures thereof; and optionally

a perfume and/or dye.

8. A ~~method for making a moulded~~ combustible pesticidal product as claimed in claim 1 in which the one or more pesticides are insecticides, preferably esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin and pyrethrins, citronella, ~~pyrethroids~~, neem oil and mixtures thereof.

9. A combustible pesticidal product as claimed in claim 8 wherein the one or more pesticides are selected from the group consisting of esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin and pyrethrins, citronella, ~~pyrethroids~~, neem oil and mixtures thereof and are in an amount of from 0.01 to 0.6% w/w.

10. A combustible pesticidal product of claim 9 wherein the pesticides are present in an amount of from 0.02 to 0.3% w/w.

11. A combustible pesticidal product of claim 10 wherein the pesticides are present in an amount of from 0.04 to 0.1% w/w.

12. A combustible pesticidal product as claimed in claim 9 wherein the one or more insecticides ~~are~~ selected from the group consisting of pyrethroids, neem oil, citronella and mixtures thereof and are in an amount of from 0.01 to 10% w/w.

13. A combustible pesticidal product of claim 12 wherein the insecticides are present in an amount of from 0.01 to 6% w/w.

14. A combustible pesticidal product of claim 13 wherein the insecticides are present in an amount of from 0.04 to 6% w/w.

15. A combustible pesticidal product as in any one of claims 7 to 14 wherein the alkali earth metal nitrate or nitrite is included in an amount of from 0.20 to 1.20% w/w.

16. A combustible pesticidal product of claim 15 wherein the alkali earth metal nitrate or nitrite is included in an amount of 1.11% w/w.

17. A combustible pesticidal product as in any one of claims 7 to 15 wherein the nitrates and nitrites are selected from the group consisting of sodium nitrite, sodium nitrate, potassium nitrite, potassium nitrate, calcium nitrite, calcium nitrate, magnesium nitrite, magnesium nitrate and mixtures thereof.

~~18. A combustible pesticidal product as in any one of claims 7 to 17 wherein the alkali earth metal carbonate or bicarbonate is in an amount of from 0.01 to 1.00% w/w.~~

~~19.~~ 18. A combustible pesticidal product of claim ~~18~~ 17 wherein the alkali earth metal carbonate or bicarbonate is present in an amount of about 0.82% w/w.

20. A combustible pesticidal product as in claim 18 wherein the carbonates or bicarbonates are selected from the group consisting of sodium carbonate, sodium bicarbonate, potassium carbonate, potassium bicarbonate, calcium carbonate, calcium bicarbonate, magnesium bicarbonate, magnesium carbonate and mixtures thereof.

21. A combustible pesticidal product as in any one of claims 7 to 20 wherein the sodium silicate is included in an amount of from 0.01 to 0.70% w/w.

22. A combustible pesticidal product of claim 21 wherein the sodium silicate is included in an amount of about 0.56% w/w.

23. A combustible pesticidal product as in any one of claims 7 to 22 wherein the phosphate is included in an amount of from 0.02 to 0.40% w/w.

24. A combustible pesticidal product of claim 23 wherein the phosphate is included in an amount of 0.14% w/w.

25. A combustible pesticidal product as in claim 23 wherein the phosphate is diammonium phosphate.

26. A combustible pesticidal product as in any one of claims 7 to 25 wherein the boron compound is included in an amount of from 0.10 to 0.70% w/w.

27. A combustible pesticidal product as in claim 26 wherein the boron compound is included in an amount of 0.66% w/w.

28. A combustible pesticidal product as in any one of the preceding claims wherein the thickness of the pulp product is from 1mm to 6mm.

29. A combustible pesticidal product as in claim 28 wherein the thickness of the pulp product is 4mm.

30. A combustible pesticidal product as in any one of the preceding claims wherein the width of the pulp product is from 3mm to 10mm.

31. A combustible pesticidal product as in claim 30 wherein the width of the pulp product is 6mm.

32. A combustible pesticidal product as in any one of the preceding claims wherein the length of the pulp product is from 500 to 1500mm.

33. A combustible pesticidal product as in claim 32 wherein the length of the pulp product is 1100mm.

33 ~~34~~. A combustible pesticidal product as in any one of the preceding claims wherein the density of the pulp product is from 300 to 1000kg/m^3.

34 ~~35~~. A combustible pesticidal product as in claim ~~34~~ 33 wherein the density of the pulp product is from 400 to 600kg/m^3.

35 ~~36~~. A combustible pesticidal product as in claim ~~35~~ 34 wherein the density of the pulp product is 600kg/m^3.

36 ~~37~~. A combustible pesticidal product as in any one of the preceding claims wherein the product has a cross-sectional combustion area shaped in a rectangle, triangle, square, half-circle, u section or combinations thereof.

37 ~~38~~. A combustible pesticidal product as in any one of the preceding claims wherein the organic fibrous materials, cellulose fibres and wood free fibres include but are not limited to waste paper and cardboard, old newspaper, kraft pulp, coconut powder, straw, bagasse, bamboo, cane, straw, grasses, weeds, tea leaves, charcoal powder, sawdust, cotton, cloth and rags, and husks of materials including rice, wheat and coconuts.

38 ~~39~~. A combustible pesticidal product as claim 7 wherein the coating is applied to the pulp by rolling, painting, printing or spraying.

39 ~~40~~. A combustible pesticidal product as in any one of the preceding claims wherein other components ~~can be~~ are added to the pulp or applied as a coating.

40 ~~41~~. A combustible pesticidal product as in claim ~~40~~ 39 wherein the components can include binders, dewatering agents, chemicals to increase the wet and dry strength of the product, starches, gums, talc and glues.

41 ~~42~~. A combustible pesticidal product as in any one of the preceding claims wherein the product is a mosquito coil having a burn time of at least 4 hours.

42 ~~43~~. A combustible pesticidal product as in claim ~~42~~ 41 wherein the mosquito coil has a burn time of 7-8 hours.

43 ~~44~~. A combustible pesticidal product as in claim ~~42~~ 41 wherein the coil is shaped as a single helical coil, double coil, triangular, hexagon, polygon, or rectangular ~~or other configurations~~.

44 ~~45~~. A combustible pesticidal product as in claim ~~44~~ 43 wherein the coil is a single helical coil and the weight of the single coil is 8 to 20 grams.

44

45 ~~46.~~ A combustible pesticidal product as in claim ~~45~~ wherein the weight of the single coil is 12 grams.

46 ~~47.~~ A method of making a combustible pesticidal product comprising the steps of:

forming a pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof,

the addition of one or more pesticides, and

moulding the product by vacuum moulding

to form a combustible pesticidal product.

46

47 ~~48.~~ A method of making a combustible pesticidal product as in claim ~~47~~ wherein the product is formed at a vacuum pressure of 0-20kPa.

~~49. A method of making a moulded combustible pesticidal product substantially as hereinbefore described with reference to the Examples 1 and 2.~~

~~50. A method of making a moulded combustible pesticidal product substantially as hereinbefore described with reference to the accompanying Figures 3a, 3b and 4.~~

~~51. A combustible pesticidal product when made according to the method of claim 47.~~

avoid breakage. Again it must be emphasised that any breakage of a coil effectively results in a coil being shortened both in length and most significantly, burn time.

Another known method of making mosquito coils is by treating thick pieces of cardboard with an insecticide. The cardboard may be made of layers of thinner sheets which are stacked on top of one another until the desired thickness is achieved. The multi-layered cardboard is then cut to the required shape of the coil. While this method reduces the breakage of the coil, the cutting of the thick cardboard results in the damage and breakage of the cutting knives. The costs associated with the regular replacement of the knives is significant.

Whilst recognising the short comings of traditional mosquito coils, the present inventors have sought to provide an improved coil which is capable of providing a prolonged effective period of insecticidal coverage and is produced in a manner resulting in a cost effective product relative to the traditional coil.

This has been achieved by recognising that rather than forming the coils as planar helices which need to be handled with some care, the coils are moulded to a form which significantly reduces the chance of breakage and does not involve cutting thick cardboard.

Disclosure of Invention

Accordingly, in a first aspect the present invention consists in a combustible pesticidal product comprising a structural element having a thickness defined by sides which slope at an angle of from 5 to 10 degrees and formed of a vacuum moulded pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof, the product including one or more pesticides,

which product on combustion emanates the pesticide into the atmosphere.

In a second aspect, the present invention consists in a method of making a combustible pesticidal product comprising the steps of:

forming a pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof,

the addition of one or more pesticides, and

moulding the product by vacuum moulding

to form a combustible pesticidal product.

charcoal powder, sawdust, cotton, cloths, rags, and husks of materials such as rice, wheat and coconuts. Preferably, old newspaper is used.

Whilst this invention is applicable to a variety of pesticidal substances, the preferred form relates to the use of insecticides, particularly insecticides that are effective against mosquitoes.

The insecticides used in this invention comprise all residual insecticides, including non-microencapsulated insecticides, microencapsulated insecticides as well as mixtures of non-microencapsulated and microencapsulated insecticides.

It is preferred that the one or more insecticides comprise substances which are toxic to mosquitoes. Without limitation, these include esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin, pyrethrins, citronella, pyrethroids, neem oil and mixtures thereof. When esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin, pyrethrins, and mixtures thereof are used, typically they will be in an amount of from 0.01 to 0.6 % w/w, preferably to 0.02 to 0.3 % w/w, most preferably 0.04 to 0.1 % w/w. When pyrethroids, neem oil, citronella and mixtures thereof are used, typically they will be in an amount of from 0.01 to 10 % w/w, preferably to 0.01 to 6 % w/w, most preferably 0.04 to 6 % w/w.

Emanation of the pesticide into the atmosphere occurs as a result of the pesticide being volatilised as the coil burns. At the front or tip of combustion of a coil, the temperature may be 200-500°C. However, behind the tip, the temperature will be somewhat lower owing to the insulation properties of the pulp. This means that compounds such as esbiothrin which boil at 160-170°C will be volatised and released into the atmosphere behind the burning tip.

The pulp may include an accelerant, being an alkali or alkali earth metal nitrate or nitrite in an amount of from 0.04 to 1.83 % w/w. Preferably, the alkali or alkali earth metal nitrate or nitrate will be included in an amount of from 0.20 to 1.20 % w/w, most preferably about 1.11 % w/w. The nitrates or nitrites that may be used include sodium, potassium, calcium, magnesium and mixtures thereof. It is preferred to utilise potassium as the nitrate or the nitrite, preferably as the nitrate.

As an alternative to the alkali or alkali earth metal nitrate or nitrite, the pulp may include an alkali or alkali earth carbonate or bicarbonate in an amount of from 0.02 to

1.83 % w/w. Preferably the alkali or alkali earth metal carbonate or bicarbonate will be included in an amount of from 0.10 to 1.00 % w/w, most preferably about 0.82 % w/w. The carbonates or bicarbonates that may be used include sodium, potassium, calcium, magnesium and mixtures thereof.

It is preferred to use potassium carbonate.

Sodium silicate may be included in the pulp in an amount of from 0.01 to 1.37 % w/w. Preferably, the sodium silicate may be included in an amount of from 0.10 to 0.70 % w/w, most preferably about 0.56 % w/w.

A phosphate in an amount of from 0.01 to 0.40 % w/w and selected from the group consisting of diammonium phosphate, monoammonium phosphate, triammonium phosphate and mixtures thereof may be included in the pulp. Preferably the phosphate may be included in an amount of from 0.02 to 0.40 % w/w, most preferably about 0.14 % w/w. Furthermore, of these phosphates, diammonium phosphate is preferred.

A boron compound in an amount of from 0.01 to 0.92 % w/w and selected from the group consisting of boric acid, sodium tetraborate hydrous, sodium borate, potassium borate, calcium borate, zinc perborate, boronatrocalcite and mixtures thereof may be included in the pulp. Preferably the boron compound may be included in an amount of from 0.10 to 0.70 % w/w, most preferably about 0.66 % w/w. Furthermore, of these boron compounds, sodium borate is preferred.

It is within the scope of this invention to include a perfume and/or a dye. Both the perfume and the dye, if included, will be selected on the basis of satisfying specific organoleptic requirements. It will of course be appreciated that the perfume must be suitably stable under the conditions of combustion of the coil.

The thickness and width of the pulp are of great importance in determining the burn rate of the coil. It is desired to have a coil which has a low burn rate as less mass is required in the coil. In a preferred embodiment, the structural element is made from moulded pulp, with dimensions of 3-10mm wide by 1-6mm thick, preferably 6mm wide and 4mm thick. The desired length is from 500 to 1500mm, preferably 1100mm. The cross-sectional combustion area is shaped in a rectangle, triangle, square, half-circle, u section or combinations thereof. Where the coil is a single helical coil, the weight of the single coil is 8 to 20 grams, preferably 12 grams.

Figure 2 is a graph showing the effect of width on burn rate of three different products with a density of 450 ± 50kg/m^3.

In order to better understand the nature of the invention, a number of examples will now be described.

Example 1

Trials were conducted to compare the effect on burn rate when the thickness, width and density of the strips were altered. Strips were produced of lengths between 4-9mm,

with a thickness of 2,3,4and 5mm at densities of 300,450 and 600kg/m^3. These strips were then burnt to determine their mass burn rate in g/h.

Figure 1 shows the effect of varying thickness and widths on burn rate.

The observed trends were that increasing width increases burn rate, and increasing thickness increases burn rate.

Figure 2 shows the effect on the burn rate of the product with a density of 450 ± 50kg/m^3 when an accelerant (KNO_3) is added to newspaper pulp and also when using white office paper instead of old newspaper as the main ingredient.

Example 2

Trials were conducted to compare the effect on burn rate when white office paper was used as the main ingredient and also when the accelerant potassium nitrate (KNO_3) was used with old newspaper. KNO_3 was added at a concentration of 0.125% in the pulp solution. Figure 2 shows that using white office paper as a raw material increases the burn rate dramatically. Likewise the addition of KNO_3 to old newspaper slightly increases the burn rate compared to old newspaper with no additives.

CLAIMS:

1. A combustible pesticidal product comprising a structural element having a thickness defined by sides which slope at an angle of from 5 to 10 degress and formed of a vacuum moulded pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof, the product including one or more pesticides, which product on combustion emanates the pesticide into the atmosphere.

2. A combustible pesticidal product as in claim 1 wherein the product is formed of a thermoformed pulp.

3. A combustible pesticidal product as in claim 2 wherein the product is thermoformed at a temperature of between 80 to 400°C, and at a pressure of between 50 to 1500kPa.

4. A combustible pesticidal product of claim 3 wherein the product is thermoformed at a temperature of 250°C.

5. A combustible pesticidal product of claim 3 wherein the product is thermoformed at a pressure of between 200 to 600kPa.

6. A combustible pesticidal product of claim 4 wherein the product is thermoformed at a pressure of 400kPa.

7. A combustible pesticidal product as in any one of the preceding claims wherein the product comprises either incorporating into the wet pulp during its preparation and/or applying to a pulp as a coating thereof at least one of the following:

an alkali or alkali earth metal nitrate or nitrite in an amount of from 0.04 to 1.83% w/w,

an alkali or alkali earth carbonate or bicarbonate in an amount of from 0.01 to 1.00% w/w;

sodium silicate in an amount of from 0.01 to 1.37% w/w;

a phosphate in an amount of from 0.01 to 0.40% w/w and selected from the group consisting of diammonium phosphate, monoammonium phosphate, triammonium phosphate and mixtures thereof;

a boron compound in an amount of from 0.01 to 0.92% w/w and selected from the group consisting of boric acid, sodium tetraborate hydrous, sodium borate, potassium

borate, calcium borate, zinc perborate, boronatrocalcite and mixtures thereof; and optionally

a perfume and/or dye.

8. Combustible pesticidal product as claimed in claim 1 in which the one or more pesticides are insecticides, preferably pyrethroids including, esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin and pyrethrins, citronella, neem oil and mixtures thereof.

9. A combustible pesticidal product as claimed in claim 8 wherein the one or more pesticides are selected from the group consisting of pyrethroids including esbiothrin, d-allethrin, prallethrin, transfluthrin, bioallethrin, esbioallethrin and pyrethrins, citronella, neem oil and mixtures thereof and are in an amount of from 0.01 to 0.6% w/w.

10. A combustible pesticidal product of claim 9 wherein the pesticides are present in an amount of from 0.02 to 0.3% w/w.

11. A combustible pesticidal product of claim 10 wherein the pesticides are present in an amount of from 0.04 to 0.1% w/w.

12. A combustible pesticidal product as claimed in claim 8 wherein the one or more pesticides are insecticides selected from the group consisting of pyrethroids, neem oil, citronella and mixtures thereof and are in an amount of from 0.01 to 10% w/w.

13. A combustible pesticidal product of claim 12 wherein the insecticides are present in an amount of from 0.01 to 6% w/w.

14. A combustible pesticidal product of claim 13 wherein the insecticides are present in an amount of from 0.04 to 6% w/w.

15. A combustible pesticidal product as in any one of claims 7 to 14 wherein the alkali earth metal nitrate or nitrite is included in an amount of from 0.20 to 1.20% w/w.

16. A combustible pesticidal product of claim 15 wherein the alkali earth metal nitrate or nitrite is included in an amount of 1.11% w/w.

17. A combustible pesticidal product as in any one of claims 7 to 15 wherein the nitrates and nitrites are selected from the group consisting of sodium nitrite, sodium nitrate, potassium nitrite, potassium nitrate, calcium nitrite, calcium nitrate, magnesium nitrite, magnesium nitrate and mixtures thereof.

18. A combustible pesticidal product of claim 17 wherein the alkali or alkali earth metal carbonate or bicarbonate is present in an amount of about 0.82% w/w.

19. A combustible pesticidal product as in claim 17 wherein the carbonates or bicarbonates are selected from the group consisting of sodium carbonate, sodium bicarbonate, potassium carbonate, potassium bicarbonate, calcium carbonate, calcium bicarbonate, magnesium bicarbonate, magnesium carbonate and mixtures thereof.

20. A combustible pesticidal product as in any one of claims 7 to 19 wherein the sodium silicate is included in an amount of from 0.01 to 0.70% w/w.

21. A combustible pesticidal product of claim 20 wherein the sodium silicate is included in an amount of about 0.56% w/w.

22. A combustible pesticidal product as in any one of claims 7 to 21 wherein the phosphate is included in an amount of from 0.02 to 0.40% w/w.

23. A combustible pesticidal product of claim 22 wherein the phosphate is included in an amount of 0.14% w/w.

24. A combustible pesticidal product as in claim 22 wherein the phosphate is diammonium phosphate.

25. A combustible pesticidal product as in any one of claims 7 to 24 wherein the boron compound is included in an amount of from 0.10 to 0.70% w/w.

26. A combustible pesticidal product as in claim 25 wherein the boron compound is included in an amount of 0.66% w/w.

27. A combustible pesticidal product as in any one of the preceding claims wherein the thickness of the pulp product is from 1mm to 6mm.

28. A combustible pesticidal product as in claim 27 wherein the thickness of the pulp product is 4mm.

29. A combustible pesticidal product as in any one of the preceding claims wherein the width of the pulp product is from 3mm to 10mm.

30. A combustible pesticidal product as in claim 29 wherein the width of the pulp product is 6mm.

31. A combustible pesticidal product as in any one of the preceding claims wherein the length of the pulp product is from 500 to 1500mm.

32. A combustible pesticidal product as in claim 31 wherein the length of the pulp product is 1100mm.

33. A combustible pesticidal product as in any one of the preceding claims wherein the density of the pulp product is from 300 to 1000kg/m^3.

34. A combustible pesticidal product as in claim 33 wherein the density of the pulp product is from 400 to 600kg/m^3.

35. A combustible pesticidal product as in claim 34 wherein the density of the pulp product is 600kg/m^3.

36. A combustible pesticidal product as in any one of the preceding claims wherein the product has a cross-sectional combustion area shaped in a rectangle, triangle, square, half-circle, u section or combinations thereof.

37. A combustible pesticidal product as in any one of the preceding claims wherein the organic fibrous materials, cellulose fibres and wood free fibres include but are not limited to waste paper and cardboard, old newspaper, kraft pulp, coconut powder, straw, bagasse, bamboo, cane, straw, grasses, weeds, tea leaves, charcoal powder, sawdust, cotton, cloth and rags, and husks of materials including rice, wheat and coconuts.

38. A combustible pesticidal product as claim 7 wherein the coating is applied to the pulp by rolling, painting, printing or spraying.

39. A combustible pesticidal product as in any one of the preceding claims wherein other components are added to the pulp or applied as a coating.

40. A combustible pesticidal product as in claim 39 wherein the components can include binders, dewatering agents, chemicals to increase the wet and dry strength of the product, starches, gums, talc and glues.

41. A combustible pesticidal product as in any one of the preceding claims wherein the product is a mosquito coil having a burn time of at least 4 hours.

42. A combustible pesticidal product as in claim 41 wherein the mosquito coil has a burn time of 7-8 hours.

43. A combustible pesticidal product as in claim 41 wherein the coil is shaped as a single helical coil, double coil, triangular, hexagon, polygon or rectangular.

44. A combustible pesticidal product as in claim 43 wherein the coil is a single helical coil and the weight of the single coil is 8 to 20 grams.

45. A combustible pesticidal product as in claim 44 wherein the weight of the single coil is 12 grams.

46. A method of making a combustible pesticidal product comprising the steps of:

forming a pulp of organic fibrous material, cellulose fibres, wood free fibres, or mixtures thereof,

the addition of one or more pesticides, and

moulding the product by vacuum moulding

to form a combustible pesticidal product.

47. A method of making a combustible pesticidal product as in claim 46 wherein the product is formed at a vacuum pressure of 0-20kPa.

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